KATHMANDU UNIVERSITY
End Semester Examination
March/April, 2025

Level : B.E.
Year : II
Time : 2 hrs. 30mins.

08 APR 2025

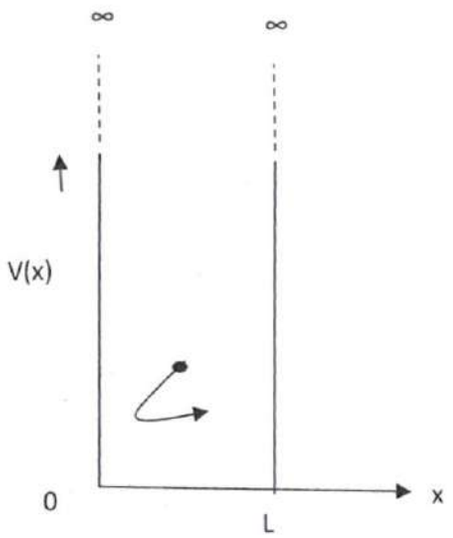
Course : EEEG 207
Semester : I
F. M. : 40

SECTION "B"

Attempt ANY FIVE questions. Symbols have their usual meanings unless stated and missing parameters can be assumed suitably.

1.

a. A particle is trapped in potential well with V(x) =0, expect at the boundaries x=0 and x=L where it is infinite large. Obtain the energy Eigen functions and energy Eigen values of the particle in a box. [4]



b. Show that the group velocity of de-Broglie waves is equal to the particle velocity. [2]

c. Consider the wave function $\psi(x,t) = Ae^{-\lambda|x|}e^{-i\omega t}$. Where A, λ and ω are real constant. Normalize ψ_N. [2]

2.

a. Show that the density of electrons in the conduction band is equal to the density of holes in the valance band in terms of band gap in intrinsic semiconductor. [4]

b. What do you mean by superconductivity? Explain the difference between the type-I and type-II superconductors using Meissner effect. [2]

c. Calculate thermal equilibrium hole concentration at $T = 400K$, assuming that the Fermi energy is $0.27\,eV$ about the valance band energy. The value of N_v for silicon at $T = 300K$ T is $1.04 \times 10^{19}\,cm^{-3}$. [2]

P.T.O.

3.

a. What is contact potential and prove that $V_0 = \frac{kT}{q} \ln \frac{p_p}{p_n}$. [4]

b. An abrupt Si p-n junction has ($A = 10^{-4}\ cm^2$) has the following properties at $300K$:

p side	n side
$N_a = 10^{17}\ cm^{-3}$	$N_d = 10^{15}\ cm^{-3}$
$\tau_n = 0.1\mu s$	$\tau_p = 10\mu s$
$\mu_p = 200 cm^2 / V - s$	$\mu_n = 1300 cm^2 / V - s$
$\mu_n = 700 cm^2 / V - s$	$\mu_p = 450 cm^2 / V - s$

The junction is forward biased by $0.5V$. What is the forward current? What is the current at a reverse bias of $-0.5V$? Given [$n_i = 1.5 \times 10^{10}\ cm^{-3}$] [4]

4.

a. Write short notes about photolithography and etching process on monolithic IC form. [2]

b. Sketch the energy band diagram of metal and $p-$type semiconductor junction when $\Phi_m < \Phi_s$. [2]

c. Distinguish between direct and indirect band gap semiconductor with appropriate graph. [2]

d. Show that the Einstein's relationship for a semiconductor is $\frac{D}{\mu} = \frac{kT}{q}$. [2]

5.

a. How can you reduce eddy current loss in magnetic materials? [2]
b. What is electromagnetic radiation? Explain in detail about the absorption (damping) constant. [1+3=4]
c. What do you understand by Piezoelectric and Pyroelectric materials? [2]

6.

a. Distinguish between active and passive dielectrics. [2]
b. What do you understand by the term Phosphorescence materials. [2]
c. What do you mean by polarization? Explain the different types of polarizations. [1+3=4]